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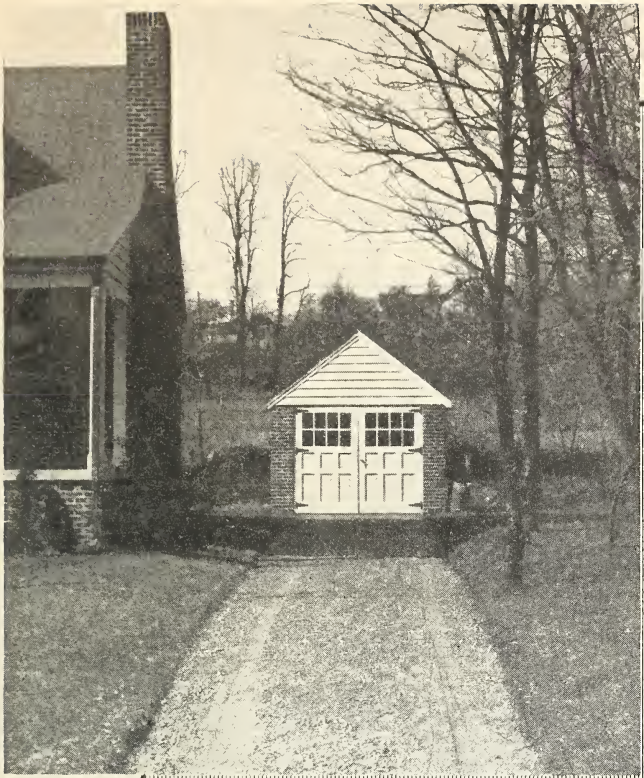

CONSTRUCTION OF PRIVATE DRIVEWAYS

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CONSTRUCTION OF PRIVATE DRIVEWAYS

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INTRODUCTION

The problem of how to build a private driveway has confronted many home owners. Some hire local contractors to plan and construct their drives. This solution of the problem is satisfactory, as an experienced contractor generally can be found who knows how to build a drive. Other home owners have sought information on methods and materials that can be used. In this latter group are many who desire to improve existing drives as well as those who wish to build new ones, and they themselves wish to do some or all of the work.

The location of a private drive is generally governed by inflexible limits that leave the owner but little choice. For this reason the problem of location is dismissed without further discussion.

The assumption is made that a single drive will serve the requirements of the home owner. If a double drive is needed, any of the designs discussed may be used, two drives built adjacent and parallel to each other being constructed instead of one.

Be sure the drainage is adequate.

Build the drive sufficiently wide and with adequate clearance on both sides.

Design the drive to give easy access to the garage from the street or alley.

Be sure the base is thoroughly compacted before placing surfacing.

Provide means for holding garage doors open.

If possible, stake out the boundaries of the proposed drive or turning area, run a car over it, and see if it seems satisfactory.

Build retaining walls on firm bases below frost line.

Allow adequate clearance so that the full turning area can be used.

Occasionally owners of adjacent lots jointly construct and use one drive extending from the street or alley to a point where separate branches lead to their individual garages. This is an arrangement that individual owners may wish to make and does not affect the following discussion of designs, materials, and construction methods.

The private drive serves as a road from the highway, street, or alley to the owner's garage. It may be used by the owner's or visitor's automobile and by coal or other delivery trucks. The drive generally passes close to the owner's house, and hence also serves as a private parking space and as a walk. To fulfill these functions, the drive must be in condition for use throughout the year.

STEEP GRADES AND RETAINING WALLS

Steep grades frequently cannot be avoided, as many homes have built-in garages that are several feet higher or lower than the street or alley. Drives that slope downward from the street or alley may have the following disadvantages:

1. In the winter the drive's surface may become coated with ice or snow, rendering the drive so slippery as to require removal of ice or snow, use of chains, or scattering sand or ashes over the surface.
2. There is some danger in backing out of the drive where the driver's view of the sidewalk and street is blocked by retaining walls, shrubs, or trees, and on very steep grades by the back of the car itself.
3. Special drainage must be provided for the drive.

Drives that slope upward from the street also have the disadvantage that they may become slippery, but generally the driver's view is not obstructed in backing down them, and they drain to the street or alley.

Drives with grades as steep as 30 percent (the equivalent of a vertical drop of 30 feet in a horizontal distance of 100 feet) have been observed, and their owners considered them satisfactory. However, they were short (less than 25 feet long). Such steep grades are not recommended.

Drives that pitch downward on a grade of more than 25 percent have additional disadvantages. Low-hanging parts of the car may scrape on the surface of the drive where the grade begins. This can be prevented by dishing the center of the drive at the high point, or by rounding off the high point. Also, the front or rear fenders and bumpers may overhang enough to scrape on the surface of the drive at the bottom of a steep grade. This can be remedied either by making the entire slope flatter or by flattening the slope for a short distance at the bottom of the grade.

Wherever it is possible, sloping drives should be built straight. It is not easy to handle a car on a curved, sloping drive, especially when backing.

Most lawns are level or nearly so, and a downward-sloping drive will require a trough through the lawn. Vertical retaining walls are frequently built along the sides of the drive, with their tops flush with the lawn. An alternative method of construction is to slope the earth upward from the top of the wall. Slopes of 1 foot of rise to 1½ feet of horizontal distance may be used where a more gentle slope is not possible. In either case the slope must be sodded.

Retaining walls are constructed of concrete, brick, or stone. Concrete is recommended for walls over 2 or 3 feet high. The thickness of a retaining wall at any point should be not less than 0.4 times the depth of the point below the top of the wall. In case the ground slopes up from the top of the wall, this factor should be increased. In no event should the ground above the wall have a steeper slope than 1 foot of vertical rise in 1½ feet of horizontal distance, and for a slope this steep the base thickness should be 0.7 times the height of the wall. The slope should be sodded to prevent erosion. A minimum top thickness of 6 inches is suggested for walls less than 5 feet high; for walls higher than 5 feet a minimum top thickness of 9 inches would be preferable.

Retaining walls should extend from 1 to 4 feet below the ground level at the base, as shown in figure 1, depending on the depth of the frost line in the particular locality or the depth to a firm base. The bottom of a retaining wall should be placed on firm, unyielding material, and should be slightly below the normal frost line.

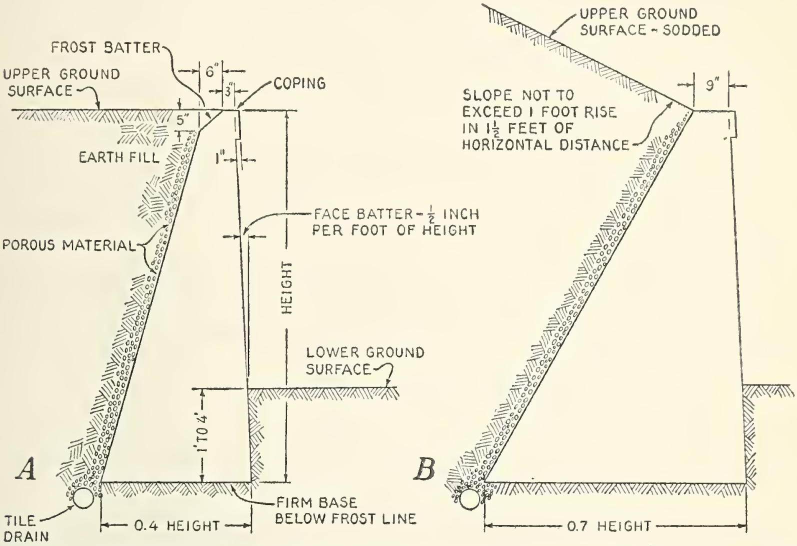
FROST BATTER
UPPER GROUND SURFACE
6"
3"
COPING
5"
EARTH FILL
1"
POROUS MATERIAL
FACE BATTER–½ INCH PER FOOT OF HEIGHT
HEIGHT
LOWER GROUND SURFACE
1' TO 4'
A
TILE DRAIN
0.4 HEIGHT
FIRM BASE BELOW FROST LINE
UPPER GROUND SURFACE – SODDED
9"
SLOPE NOT TO EXCEED 1 FOOT RISE IN 1½ FEET OF HORIZONTAL DISTANCE
B
0.7 HEIGHT

FIGURE 1.—Cross sections of gravity retaining walls: *A*, Upper ground surface level, showing frost batter and coping at the top of the wall; *B*, upper ground surface sloping, showing added thickness of base needed for the slope shown.

The designs shown in figure 1 are merely suggested as a general guide. It would be preferable to build the wall upon a rectangular footing of concrete or masonry having a depth of approximately 8 inches and extending 6 inches beyond the face of the wall on each side.

A line of drain tile with a suitable outlet should be placed along the footing of the retaining wall. In clay soils it is desirable to fill over the tile (against the retaining wall) with porous material such as gravel, slag, cinders, ashes, or sand. The purpose of the tile and porous fill is to prevent the fill back of the wall becoming saturated and exerting great pressure against the wall. Of even greater importance is the prevention of horizontal thrust from the freezing of saturated soil. Retaining walls have been observed that were tilted over 2 or 3 inches each winter by the thrust from freezing, until finally they had to be rebuilt. Damage from this thrust can be reduced by sloping the top of the wall, as shown in figure 1. This slope, or frost batter, will provide a surface over which freezing soil can slide as it expands, thus relieving some of the pressure against the wall.

Avoid high retaining walls in combination with poor drainage as the wall, no matter how well built, will be pushed out at the top by the freezing of saturated soil.

The appearance of a retaining wall can be improved by providing face batter of not less than one-half inch per foot of height. An absolutely vertical wall has the appearance of toppling, and this amount of face batter will make the wall appear to be vertical. A coping along the top of the wall will also improve its appearance.

When retaining walls are used, the slab type of drive is recommended, and the width should be at least 8½ feet between walls for straight drives. This width is needed because, although the two front or rear wheels are only about 4.8 feet apart, the car's fenders and running board overhang about 8 inches on each side and there should be some additional width to permit easy handling of the car.

Garage doors should provide a clear opening at least 8 feet wide and 7 feet high. Garage doors opening outward require that the 4 or 5 feet of drive adjacent to the garage be level or slope downward away from the garage. It is recommended that the 15 or 20 feet of drive adjacent to the garage be made as nearly level as is practicable. This provision will be an aid in handling the car when entering or leaving the garage.

Means of holding swinging doors open should be provided. Doors opening outward can often be fastened to retaining walls by hooks, or small holes may be made in the drive to engage latches on the bottom of the doors.

PROVISIONS FOR DRAINAGE

Drainage is not often a serious problem in drive construction, as most drives are not over 100 feet in length and drain but a small area. However, care should be taken to insure the prompt disposal of water that may collect and run onto the drive. This can usually be accomplished by constructing the drive on a slight grade and by diverting surface water that might run onto the drive. Surface drainage will adequately dispose of rain water in almost every instance. If underground drainage must be used, a line of 4-inch tile placed about 1 foot below the surface will usually suffice. Care should be taken to place sandy soil, gravel, or other porous material over the tile, as clay or impervious covering will prevent percolation and the proper functioning of the drain.

Drives that slope downward to the garage can be drained by installing a drainage inlet in the center of the drive about 4 feet in front of the garage doors, and connecting this inlet with the sewer outlet serving the house. The garage floor can be sloped so that it also drains to this inlet. City regulations sometimes prohibit carrying outside surface water to a sewer or limit the area that may be so drained. Local authorities or a plumber should be consulted on this point, also as to fees and permits for sewer connections.

It sometimes happens that a drive is so located that considerable water passes over it during rainfall and erodes the surface. Most often the washing occurs on steep grades. Home owners frequently inquire how washing of crushed stone, slag, or gravel surfaces can be prevented. There is no simple and inexpensive remedy for such a situation. Either the water must be diverted to other channels or the surface must be made erosion resistant. If a crushed stone, slag, or gravel surface is already in place the desired result can probably be obtained most economically by applying a bituminous surface treatment, provided the washing is not too severe. Surfacing with portland-cement concrete, a bituminous mixture, or brick will also accomplish the desired result.

A private drive is similar to a public highway in that both require durability, smoothness, freedom from dust or mud, and should require but little maintenance. These qualities are obtained by the use of the proper materials and construction methods and by provision for adequate drainage. However, a private drive is subjected to less severe usage than is a public highway, as the number and speed of vehicles using the drive are considerably less. For this reason the required widths and thicknesses of surfaces are less for drives.

MATERIALS FOR DRIVES

The materials available for or adaptable to drive construction vary in different sections of the country. For convenience in subsequent treatment they may be placed in three groups, as follows:

Group 1.—Soil, sand-clay, caliche, shell, scoria, cinders, crushed slag, gravel, and crushed stone.

Group 2.—Rock asphalt, bituminous mixes, asphaltic concrete, bituminous materials with a cover of stone chips, crushed gravel, or slag, and cement-bound macadam.

Group 3.—Portland-cement concrete and brick.

Drives may be built of any of the above-mentioned materials used either as a solid slab throughout or as parallel "ribbons" furnishing separate paths for the wheels. Either type will give satisfaction, though the solid-slab type requires more material and hence is more expensive than the ribbon type.

CONSTRUCTION WITH MATERIALS OF GRAVEL TYPE

Materials listed under group 1 are those used in low-type road construction and are the lowest in cost. Construction of a drive with any of these materials should involve practically no equipment cost; expenses of preparing the subgrade, cost of delivered materials, and cost of spreading should make up all of the expense items involved.

Such materials as scoria, shell, and caliche are available in but few sections of the country; construction methods with these materials are essentially the same as for gravel. Construction with soil and sand-clay is not recommended except in instances where other materials of this group are not available.

Slag is a material produced as a byproduct from blast furnaces. It is now obtainable in most cities east of the Mississippi River and in different commercial sizes.

GRADATION

In constructing a gravel, crushed-slag, cinder, or crushed-stone drive, care should be taken to obtain material that is reasonably well graded from coarse to fine (fig. 2). The maximum particle size should not exceed three-fourths of an inch, and the gradation for mixtures containing smooth, round gravel particles should be approximately as follows:

Passing:	Percent
¾-inch sieve	100
¼-inch sieve	50
No. 10 sieve	40
No. 200 sieve	10

A ¾-inch sieve is one having square openings measuring three-fourths of an inch each way; it will just pass material about the size of a chestnut. A ¼-inch opening is about the size of a pea. Material passing a no. 10 sieve is smaller than grains of rice. Material passing a no. 200 sieve is like finely ground flour in size.

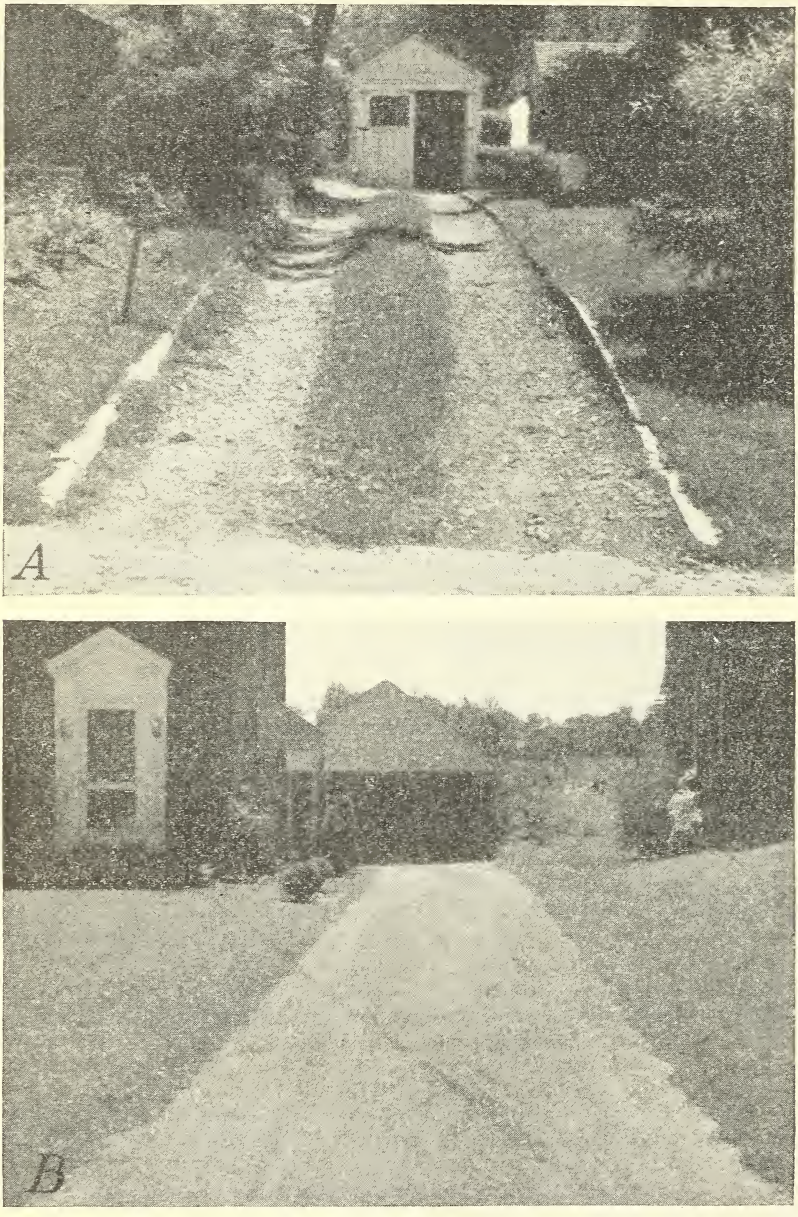

FIGURE 2.—Gravel and crushed-stone drives. *A*, The gravel on this ribbon-type drive is not well graded, as large rocks are strewn over the surface. Considerable improvement could be made by adding another course of better graded material. *B*, Well-graded crushed stone with stone dust or other filler makes a satisfactory surfacing material. This drive is 8 feet wide and has a slight crown.

A material having exactly the above-mentioned grading will seldom be available; the figures are presented as a general guide to the builder. A wide variety of gradings have been used for highway surfaces, with good results. A few simple rules should be kept in mind in selecting materials. Pieces of stone, gravel, or slag larger than three-fourths of an inch in diameter cannot be consolidated properly by the methods that must be used, and a rough surface will result. If a large portion of the material is of the coarsest size it will not readily pack and make a smooth, hard surface. A small amount of very fine material is needed to act as a binder, but a large amount of clay will result in rutting.

Often a rather poor material can be changed to an excellent one by the addition of the proper amount of coarse or fine material. It should be kept in mind that a surface of maximum density (no air spaces after consolidation) is desired. The coarse particles serve to withstand wear and to distribute the load, and the fine particles serve as binder and hold the coarse particles in place. Crushed stone, crushed slag, or crushed gravel with sharp, angular edges are preferable to river-run gravel with round particles, as the former give better interlocking action and hence have greater stability. Because of this greater stability they do not require as much fine material as do mixtures containing smooth, round gravel particles.

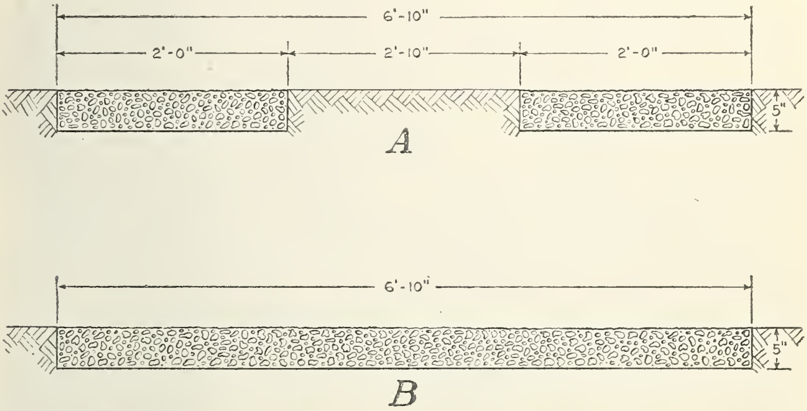

Figure 3.—Suggested cross sections for gravel, crushed-stone, crushed-slag, or cinder drives: *A*, Ribbon type; *B*, slab type.

CROSS SECTIONS

Figure 3 shows suggested cross sections for drives constructed with materials of group 1. Figure 3, *A*, shows the ribbon type, consisting of parallel strips of material. The thicknesses adopted may vary from 2 to 6 inches for materials of group 1. In some instances the home owner can improve his present drive by placing 1 or 2 inches of well-graded material on top of the existing surface.

QUANTITIES OF MATERIALS

Table 1 shows the quantities of materials required for various thicknesses of surface for the two designs shown in figure 3. These quantities are given for lengths of 100 feet for ease in converting to quantities for any length desired.

TABLE 1.—*Quantities of materials required for drives built with group 1 materials*

QUANTITIES FOR WIDTHS SHOWN IN FIGURE 3

Type of construction shown in figure—	Quantity per 100 feet for compacted thicknesses of—				
	2 inches	3 inches	4 inches	5 inches	6 inches
	Cu. yds.	*Cu. yds.*	*Cu. yds.*	*Cu. yds.*	*Cu. yds.*
3, *A*	2.47	3.70	4.94	6.17	7.41
3, *B*	4.22	6.33	8.44	10.55	12.65
QUANTITIES FOR EACH ADDITIONAL INCH OF OVER-ALL WIDTH					
3, *A*	0.10	0.16	0.21	0.26	0.31
3, *B*	.05	.08	.10	.13	.16

Soil, sand-clay, and caliche are generally purchased by volume, usually measured in cubic yards. As these materials shrink about 10 percent when compacted, the quantities shown should be increased by 10 percent to obtain the thicknesses indicated.

The rest of the materials in group 1 are generally purchased by the ton. If these materials are used, the volumes given in the table will need to be converted to tons. The following figures are approximate weights in pounds per cubic foot of these materials when compacted: Shell, 80; scoria, 105; cinders, 50; slag, 80; gravel and crushed stone, 120. As an example, for 100 feet of 5-inch thickness of gravel for the design shown in figure 3, *A*,

weight of 6.17 cubic yards$=6.17\times120\times0.0135=10$ tons.

The value 0.0135 is a constant that will be used in each calculation. It represents the fraction twenty-seven over two thousand, which must be applied to convert cubic yards to cubic feet and to convert pounds to tons.

For each 1-inch increase in width of a slab drive, a strip of additional material 1 inch wide is needed. For each 1-inch increase in over-all width of a ribbon drive, however, two 1-inch strips of additional material are needed, since the width of each ribbon must be increased by 1 inch. Therefore, in the second part of table 1, which shows quantities of materials required for each additional inch of over-all width, the quantities for ribbon drives are twice those for slab drives. For example, suppose it is desired to calculate the amount of material for a ribbon drive of gravel 88 inches in over-all width and having a compacted thickness of 5 inches. This drive is 6 inches wider than the design shown in figure 3, *A*. From table 1 the quantity of gravel needed is $6.17+(6\times0.26)$ or 7.73 cubic yards, which equals $7.73\times120\times0.0135$ or 12.52 tons. For a slab drive of gravel 88 inches wide and 5 inches thick the quantities would be $10.55+(6\times0.13)$ or 11.33 cubic yards, which equals $11.33\times120\times0.0135$ or 18.35 tons.

CONSTRUCTION METHODS

The methods of constructing a drive of either design shown in figure 3 are rather simple. Trenches of the size and shape of the cross section adopted are dug throughout the drive's length. Loose earth in the bottom of the trench should be consolidated by hand tamping or by driving a car back and forth over it. Materials delivered to the drive by truck can be dumped and partially spread along the drive by the truck, or they may be piled in one place near the drive and distributed with a wheelbarrow. The latter procedure is preferable if the material contains oversize rock or gravel as these can be raked out and placed as the bottom layer in the trench. Whichever procedure is followed, the final shaping should be done with a hand shovel and rake. The finished surface should preferably be flush with the adjacent ground.

A drive constructed with any of this group of materials may well be built by stages. The trench should be dug and a 1½- or 2-inch layer of material spread. This should be wet down a little and used for a week or two and then another layer placed. In this manner better consolidation of the material is obtained than would be possible were all of the material put down as one layer. When first placed, the surfacing material will be loose and churn under vehicle wheels; but a good mixture will gradually consolidate into a compact mass. During this period it should be raked regularly to keep a smooth surface and prevent ruts from forming.

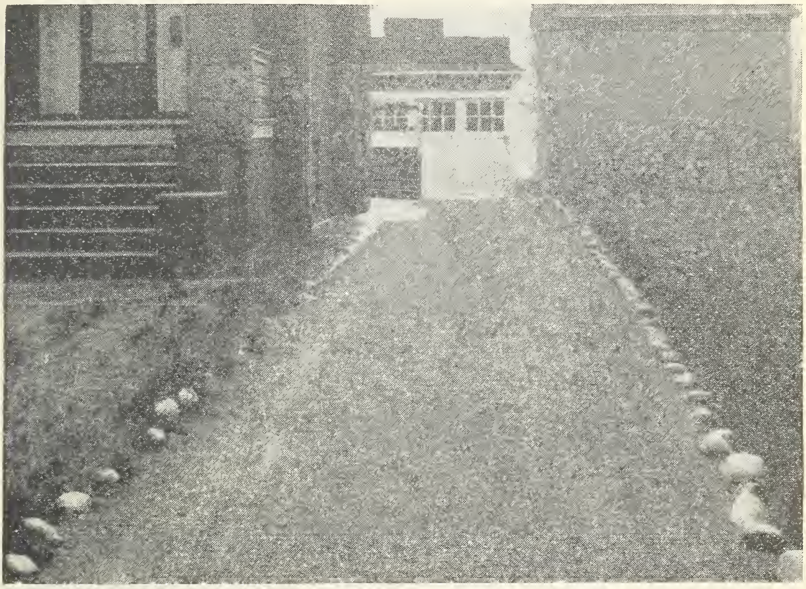

FIGURE 4.—A slag drive constructed by the owner.

Drives of the type shown in figure 3, *B*, may be built with a slight crown; preferably the center should not be more than 1 inch higher than the edges.

Figure 4 shows a drive surfaced with slag.

An inexpensive but satisfactory drive can be built of cinders (fig. 5). The home owner may be faced with the need of disposing of cinders anyway, and by spreading them on his drive there will gradually be built up a layer of satisfactory surfacing material. Such a procedure may be used in building a base course to be covered later with 1 or 2 inches of crushed stone, crushed slag, or crushed gravel. Use of the drive while the layer of cinders is being accumulated will insure that the cinders will become well compacted.

MAINTENANCE

If, on completion, it is found that the surface does not become a compact, solid mass after being used for several days, either material is needed to fill in the voids between the large particles of stone or gravel, or else a small amount of clay is needed to cement the particles together. Unsatisfactory mixtures can usually be corrected by scattering materials such as slag screenings, sandy soil, sand, clay, or ashes over the surface, either singly or in combination. Some judgment is needed in selecting the material to be applied.

If the surface becomes somewhat muddy during wet weather the condition can be corrected by the application of sand, stone chips, slag screenings, or cinders, preferably when the surface is damp and vehicle wheels will help to work the material in.

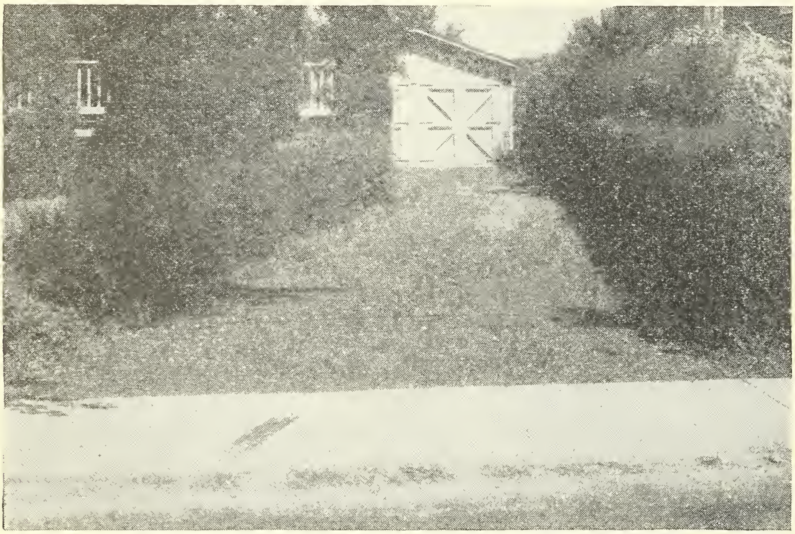

FIGURE 5.—A serviceable drive surfaced with cinders.

A dusty drive can be improved by scattering used crank-case oil over the surface. Oil will kill grass and should be applied only to the drive surfacing. The amount of oil added should be the minimum that will accomplish the desired result.

CONSTRUCTION WITH BITUMINOUS MATERIALS

The materials listed under group 2 are sometimes used in drive construction. Construction with this class of material requires special equipment, familiarity with the qualities of the various materials, and close attention to the details of construction. These types are recommended only where arrangements can be made with a contractor engaged in similar work or with a producer of these materials to supervise the work or to place the surface. The following information is given to aid in dealing with the builder. No attempt will be made to describe the mixing and placing of bituminous mixtures in sufficient detail to guide an inexperienced person.

Table 2.—*Quantities of materials required for drives built with group 2 materials*

QUANTITIES FOR WIDTHS SHOWN IN FIGURE 6

Type of construction shown in figure—	Quantity per 100 feet for surface thicknesses of—			Quantity per 100 feet for base[1] thicknesses of—			
	½ inch	¾ inch	1 inch	3 inches	4 inches	5 inches	6 inches
	Tons	*Tons*	*Tons*	*Tons*	*Tons*	*Tons*	*Tons*
6, *A*	1.11	1.67	2.22	6.00	8.00	10.00	12.00
6, *B*	1.90	2.84	3.79	10.25	13.67	17.08	20.50
QUANTITIES FOR EACH ADDITIONAL INCH OF OVER-ALL WIDTH							
6, *A*	0.05	0.07	0.09	0.25	0.33	0.42	0.50
6, *B*	.02	.03	.05	.13	.17	.21	.25

[1] Base of compacted gravel or crushed stone. For base of crushed slag, quantities required will be ⅔ of the numbers shown, as slag weighs about ⅔ as much as an equal volume of gravel or crushed stone.

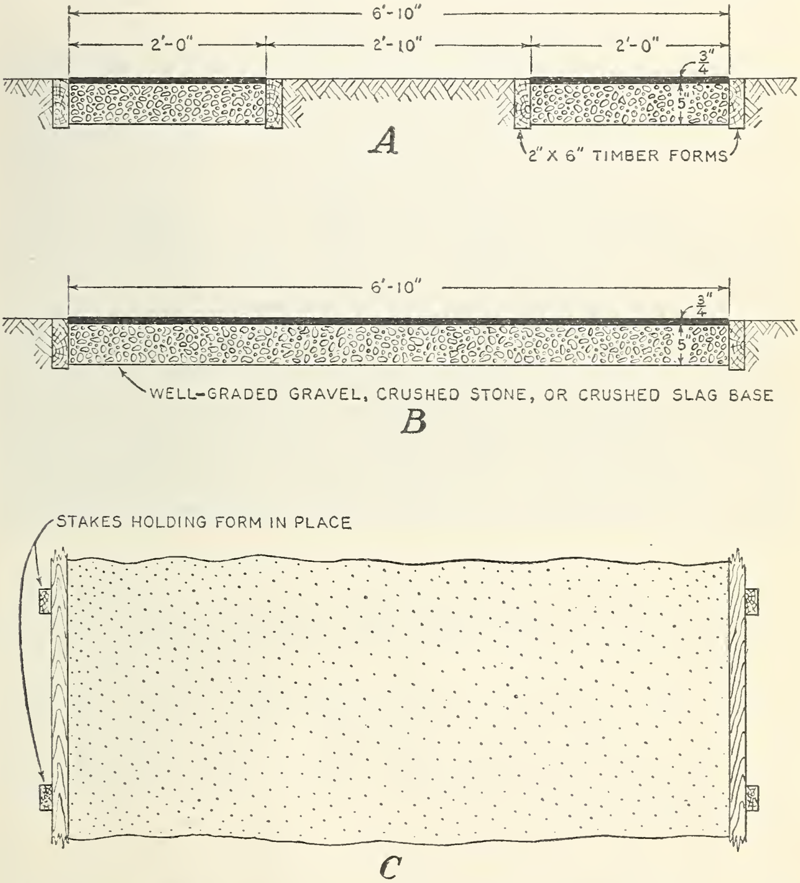
6'-10"
2'-0"
2'-10"
2'-0"
3/4"
5"
A
2" X 6" TIMBER FORMS
6'-10"
3/4"
5"
WELL-GRADED GRAVEL, CRUSHED STONE, OR CRUSHED SLAG BASE
B
STAKES HOLDING FORM IN PLACE
C

Figure 6.—Suggested cross sections for bituminous-mix and asphaltic concrete drives: *A*, ribbon type; *B*, slab type; *C*, plan of slab-type drive showing stakes holding forms in place.

CROSS SECTIONS

Suggested cross sections for straight bituminous-type drives are shown in figure 6. Drives of the type shown in figure 6, *B*, can be built with a ½- to 1-inch crown to provide for drainage.

QUANTITIES OF MATERIALS

Quantities of materials required for 100-foot lengths of the two designs shown in figure 6 are given in table 2. These quantities are for the compacted thicknesses and are given in tons as these materials are generally purchased by weight.

CONSTRUCTION METHODS

The trench should be dug as required—true to line, grade, and cross section—and side forms of 2- by 4- or 2- by 6-inch lumber should be placed with the 4- or 6-inch side vertical and the top flush with the adjacent ground, if it is graded smooth. The top of the finished bituminous surface should be ¼-inch higher than the side forms. The forms are held in place by wooden stakes, as shown in figure 6, *C*. A layer of well-graded crushed stone, crushed slag, or gravel not less than 3 inches in thickness should be spread and rolled, and on this base the surface course should be spread and rolled smooth. In building highways of this type, the compacted base is generally given a prime coat of bituminous material, applied cold. This treatment penetrates down into the base and binds the particles together. The use of this prime coat is recommended in drive construction.

Most bituminous concretes are prepared by mechanically mixing bituminous materials with properly graded aggregates that have been heated. Such mixtures must be spread evenly and rolled while still hot. Other bituminous mixes may be mixed and laid at normal atmospheric temperatures. Standard equipment such as is used on street and highway construction gives the best results, but improvised equipment or hand methods are sometimes used with fair success in mixing and placing those mixtures that can be handled without heating. In a number of large cities commercial plants sell and deliver ready-mixed bituminous mixtures that can be laid cold. Where the ready-mixed materials are available, this is probably the most convenient means of obtaining bituminous surfacing that will prove satisfactory.

Bituminous-type drives can be constructed according to the so-called "penetration" method. The aggregates are evenly distributed over the drive and rolled. The grading of the aggregate must be such that there are openings through which the bituminous material can penetrate. Bituminous materials, either hot or cold, are then sprayed over the surface and allowed to penetrate down through the aggregates. The material can be hand-poured, but this method is not nearly as satisfactory as application with a pressure distributor. Crushed slag, stone chips, or coarse sand are next spread over the surface in a thin layer.

Figures 7, 8, and 9 show drives constructed with bituminous materials.

Gravel, crushed rock, or slag drives can be improved by treating the surface with bituminous material. The existing surface is first smoothed, bumps being leveled and ruts filled with well-graded material. Bituminous material is then sprayed over the surface and immediately covered with a thin layer of fine graded sand, crushed rock, or slag.

Highways and streets constructed of bituminous mixes, asphaltic concrete, and natural rock asphalts need to be consolidated with a roller in order to obtain the necessary compaction and smoothness. For best results, a self-propelled roller should be used. If a satisfactory roller is not available, compaction can be obtained by using iron tampers weighing about 25 pounds and having a flat bearing area of not more than about 48 square inches.

In highway construction low-type bituminous surfaces are sometimes left to be compacted by the traffic using the highway. The traffic on drives is generally so small that compaction by traffic cannot be obtained unless a truck or passenger car is driven over the drive repeatedly, care being taken to run the wheels over all parts of the drive a number of times.

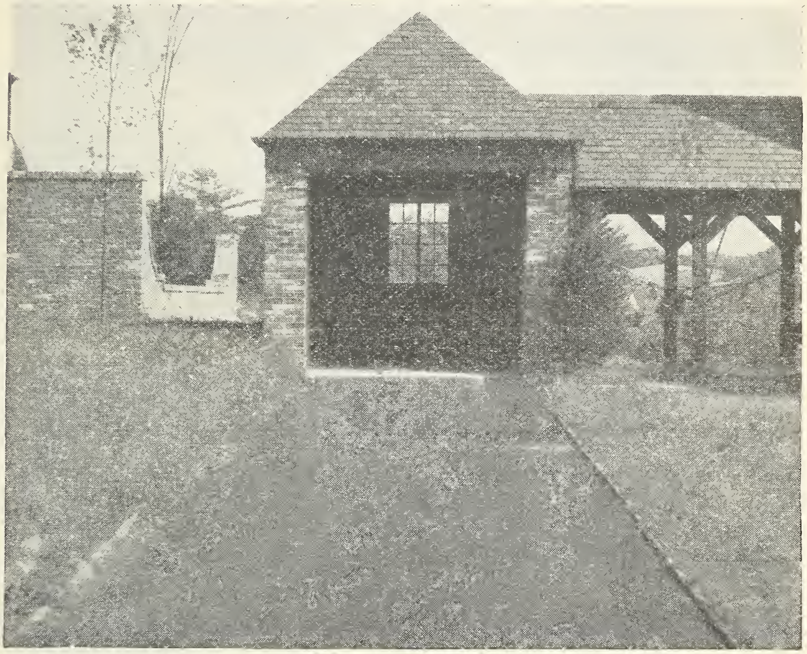

FIGURE 7.—Bituminous-treated gravel is sometimes used in drive construction. This drive has been used sufficiently to keep the surface well compacted.

Aggregates for a cement-bound macadam drive should be spread on the compacted subgrade and rolled. Side forms are required to hold the material in place. The layer of compacted aggregate should be not less than 4 inches thick. It should have a fairly coarse grading so that when it is rolled to an even surface having a crown of approximately 1 inch, there will be openings through which grout can penetrate. The grout consists of 1 part of portland cement and 2 parts of fine sand, mixed with enough water to make a thin paste. The compacted surface is first lightly sprinkled with water. Grout is then spread on the surface and worked down into the aggregates by being brushed back and forth with a broom.

The surface can be given a rough finish by brooming, or more grout can be applied and a smoother finish obtained with a wood float. Operations should be timed so that grout is applied and finished within 30 minutes after it has been mixed.

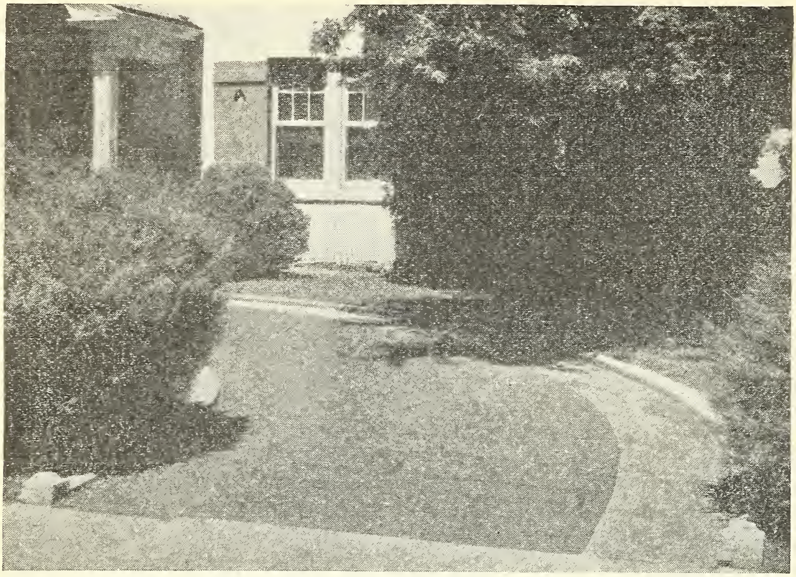

FIGURE 8.—The bituminous-mix drive has a smooth and attractive surface. Special mixing and rolling equipment must be used in constructing this type of surface.

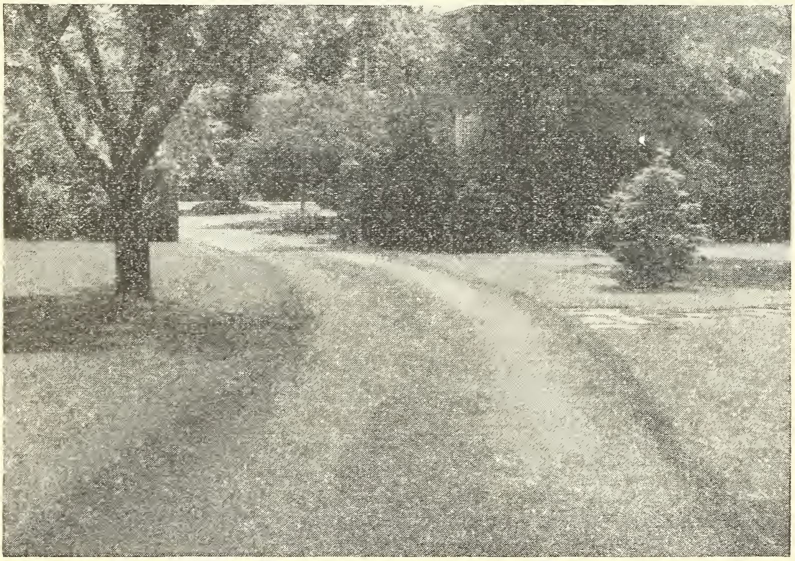

FIGURE 9.—A bituminous-slag drive laid on a crushed-stone base. This drive has been in use for about 2 years.

After the surface has hardened it should be covered and cured in the same manner as described later for concrete drives. Expansion and contraction joints should be provided for cement-bound macadam drives.

MAINTENANCE

Drives built of any type of material may be affected by frost heave, and this action is particularly detrimental to bituminous drives. Traffic serves as an aid in recompacting roads loosened by frost heave, but drives generally have insufficient usage to obtain this benefit. Hence bituminous drives loosened by frost heave should be compacted with a roller or truck to keep them from going to pieces.

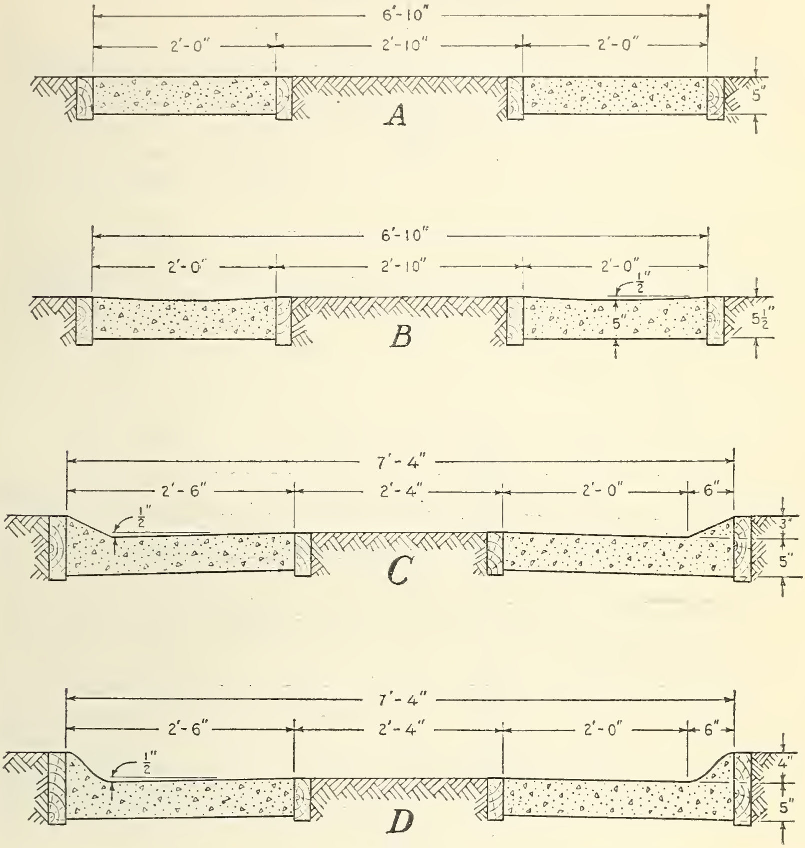

FIGURE 10.—Suggested cross sections for ribbon-type concrete drives: *A* and *B*, drives without curbs; *C* and *D*, drives with curbs.

CONSTRUCTION WITH CONCRETE

Portland-cement concrete is often used as a material in constructing drives.

CROSS SECTIONS

Figures 10 and 11 show suggested cross sections for straight concrete drives. The 5-inch thickness is considered adequate to meet the load requirements of practically all drives. However, if heavy trucks will use the drive occasionally, a 6- or 7-inch thickness may be needed.

It should not be inferred that the drives shown in figure 3 are of the same quality as those shown in figures 10 and 11 merely because the thickness of each type is 5 inches. Concrete is a higher type of surfacing. Failures in concrete surfaces cannot be repaired so readily as those in gravel, and there should be an ample margin of safety to prevent cracking caused by temperature changes, uneven subgrade support, occasional excessive loads, and other causes.

Materials for concrete and proportioning and mixing will not be discussed in this publication. Suitable information will be found in Department of Agriculture Farmers' Bulletin 1772, Use of Concrete on the Farm, which may be purchased from the Superintendent of Documents, United States Government Printing Office, Washington, D. C., for 5 cents. In cities ready-mixed concrete may be purchased delivered on the job. Prices vary considerably, but they are usually below what it will cost to buy materials and mix them by hand methods.

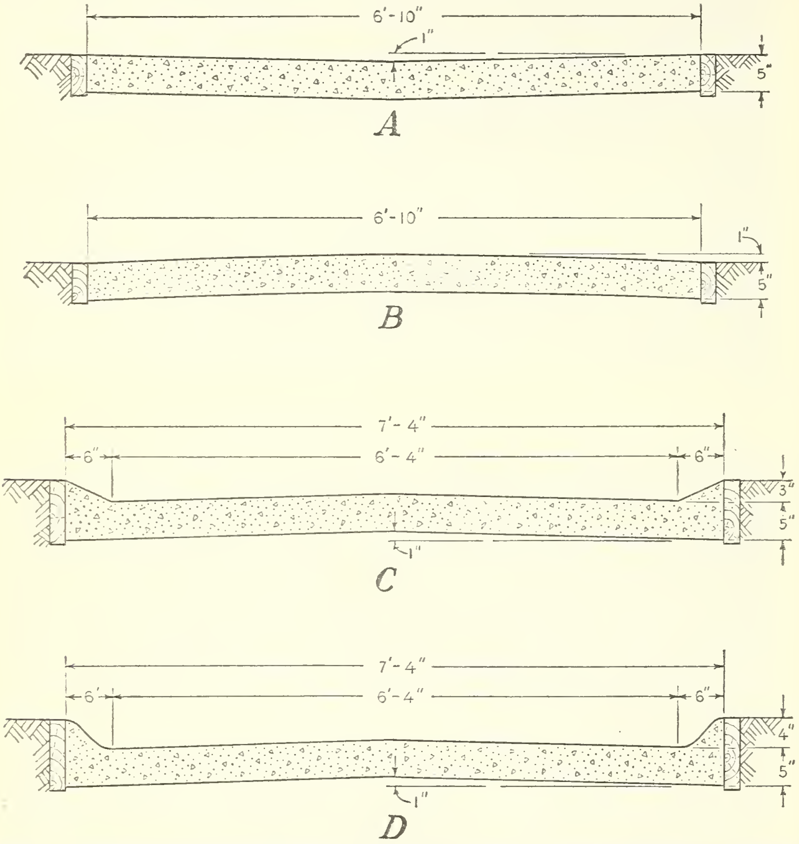

FIGURE 11.—Suggested cross sections for slab-type concrete drives: *A* and *B*, drives without curbs; *C* and *D*, drives with curbs.

Ready-mixed concrete has the advantages that the quality is likely to be better than that of concrete proportioned by an inexperienced worker; machine mixing is better than hand mixing; the hard labor of hand mixing is avoided; purchasing of materials is simplified; and no clean-up of mixing equipment and surplus material is necessary. It has the disadvantage that all of the concrete must be distributed and finished quickly, before it hardens and becomes unworkable.

Specifications commonly require that concrete be placed and compacted within 30 minutes after being mixed. This is a conservative limitation, particularly in cool weather. The builder of a drive may find it necessary to take a longer time, but he should keep in mind that there is a loss in strength when concrete that has begun to stiffen is placed. At least two workers should be present to place and finish a truckload, and possibly three workers may be needed for ribbon-type drives. Where more than one truckload is required proper arrangements should be made regarding time of delivery.

QUANTITIES OF MATERIALS

Table 3 gives quantities of concrete required by the various designs shown in figures 10 and 11 for thicknesses from 4 to 7 inches, inclusive. The designs shown in figure 10, *C*, and 10, *D*, and figure 11, *C* and 11, *D*, have curbs that are an aid in keeping the car on the drive. These curbs require small amounts of additional concrete, but the slight increase in expense is often justified.

TABLE 3.—*Quantities of concrete required for concrete drives*

QUANTITIES FOR WIDTHS SHOWN IN FIGURES 10 AND 11

Type of construction shown in figure—	Quantities per 100 feet for thicknesses of—			
	4 inches	5 inches[1]	6 inches	7 inches
	Cu. yds.	*Cu. yds.*	*Cu. yds.*	*Cu. yds.*
10,*A*	4.94	6.17	7.41	8.65
10,*B*	5.25	6.48	7.72	8.96
10,*C*	6.64	8.18	9.72	11.27
10,*D*	6.79	8.33	9.88	11.42
11,*A*	8.44	10.55	12.65	14.77
11,*B*	8.44	10.55	12.65	14.77
11,*C*	9.52	11.78	14.04	16.32
11,*D*	9.67	11.93	14.20	16.47

QUANTITIES FOR EACH ADDITIONAL INCH OF OVER-ALL WIDTH

10,*A*	0.21	0.26	0.32	0.37
10,*B*	.24	.29	.34	.39
10,*C*	.21	.26	.32	.37
10,*D*	.21	.26	.32	.37
11,*A*	.11	.13	.16	.18
11,*B*	.11	.13	.16	.18
11,*C*	.11	.13	.16	.18
11,*D*	.11	.13	.16	.18

[1] Designs as shown in figs. 10 and 11.

CONSTRUCTION METHODS

After the desired cross section has been selected, the drive is excavated to the proper depth and width. The bottom of the excavation or subgrade must have a fairly uniform bearing power. All soft and yielding material and all loose rocks or boulders must be removed or broken off to a depth several inches below the subgrade and the hole refilled with tamped material. Special precautions should be taken to insure that the subgrade is well compacted before concrete is placed, as settlement of the subgrade may result in cracking and settlement of the concrete. This is particularly true for ribbon-type drives. Construction of a concrete drive on ground that has recently been filled in might well be postponed for a year or more. Meanwhile, 2 or 3 inches of crushed stone, crushed slag, crushed gravel, or cinders could be placed and the drive used until the fill has settled. This layer of material could then be leveled and serve as a base course on which the concrete is placed.

Side forms of 2- by 6- or 2- by 8-inch lumber are placed with the 6- or 8-inch side vertical, and held in place with stakes. The forms should be set with their tops flush with the adjacent ground if it is graded smooth, and set to true line. Tamped earth on the outside will aid in keeping the forms in line during the placing and the finishing of the concrete. If the soil is a sticky clay it will be best to excavate the trench to such depth as to permit the placing of a layer of gravel, crushed stone, ashes, or cinders as a base course. The concrete is dumped on the subgrade and spread evenly to a height a little above the side forms. The concrete should be spaded or tamped to insure consolidation, to prevent honeycombing, and to work mortar to the surface for proper finishing. A wood float should be used to finish the surface in order to get a smooth, nonskid drive. A metal float will give a smoother surface on which skidding will occur more readily.

For the slab types of drive shown in figure 11, a wood template cut to the shape of the surface will aid in forming the desired surface. A wide rubber or canvas belt, pulled back and forth transversely, will also aid in consolidating and shaping the surface.

As soon as the concrete has hardened sufficiently to prevent excessive marring of the surface, it should be covered with old burlap, an old carpet, or other material and kept thoroughly wet by sprinkling. The covering should remain in place at least 1 day; then it may be removed and the surface covered with earth, sand, or straw and kept moist by sprinkling. This final cover should remain in place for at least 3 days, depending on weather conditions; after that time it may be removed and the drive put into use.

For drives less than 40 feet in length no expansion joints are needed. Possibly cracks may form at intervals as a result of contraction, and it will be best to provide contraction joints at intervals of 10 feet during construction by placing thin boards, or pieces of sheet metal to form vertical planes of separation.

On drives more than 40 feet long expansion joints should be placed every 20 or 30 feet. If tarred felt or other prepared joint material can be obtained from a contractor or building-supply dealer such material should be used. It should be backed by a board and staked in place. When the concrete has been placed on both sides the stakes can be removed. After the concrete has hardened the filler projecting above the surface is shaved off with a square-pointed shovel. Careful finishing is needed at the joints to avoid high spots.

If prepared joint material is not readily available an expansion space can be formed by placing a dressed board about 1 inch thick at each joint location. Stakes can be used to hold the boards in position until they are supported by concrete on both sides. The board should be planed and greased, and should be pulled out when the concrete hardens, before it acquires such strength that it is difficult to remove the board. The opening left should be filled to within about one-half inch of the top of the concrete with semisolid roofing asphalt or some kind of compressible material, the kind that has to be heated so that it will pour. After the joint is poured, a little sand should be sprinkled over the top.

In most of the designs shown in figures 10 and 11 drainage is provided by a slight crown. Provision must be made for prompt disposal of the water at the low end of the drive for those designs (fig. 10, *B*, *C*, *D* and fig. 11 *A*, *C*, *D*) where the drive itself acts as a trough.

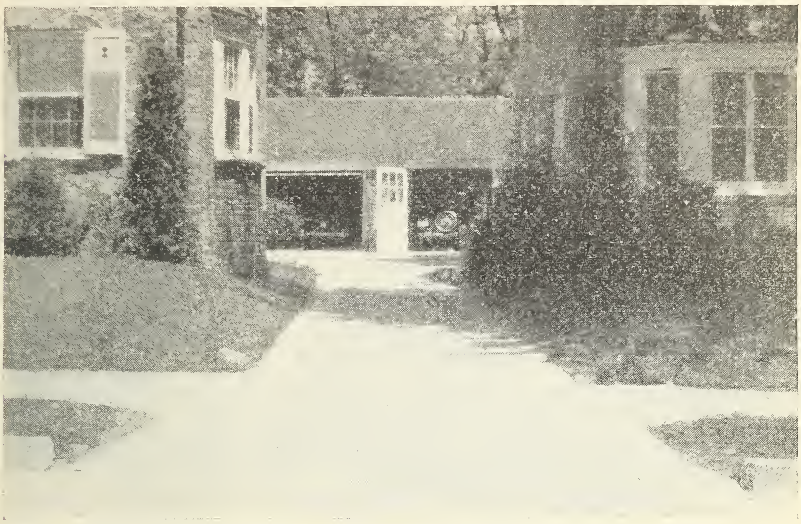

FIGURE 12.—This slab-type concrete drive is used by adjacent home owners.

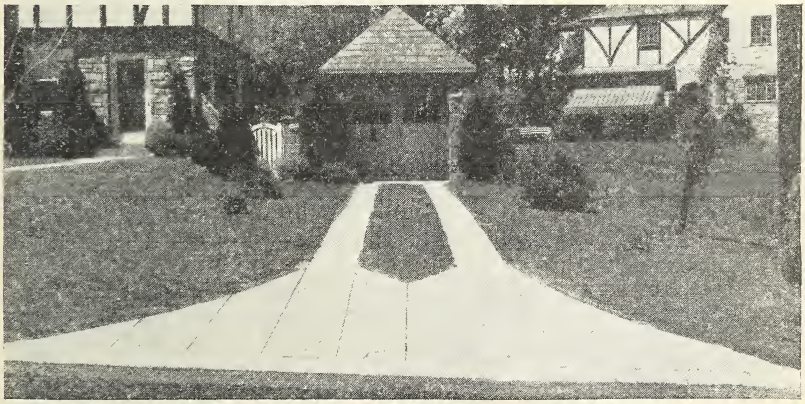

FIGURE 13.—The concrete ribbons on this drive are only 19 inches wide. However, this width is probably sufficient for short, straight drives. A wide street entrance is provided for this drive.

Use of reinforcing steel is not necessary in most cases as plain concrete properly placed is considered adequate for most drives.

Properly constructed concrete drives should give many years of service and should require practically no maintenance.

Figures 12, 13, and 14 show drives constructed of concrete.

CONSTRUCTION WITH BRICK

Drives are not as commonly constructed of brick as of others materials as brick construction generally costs more. However they make a satisfactory drive, present a pleasing appearance, and are often used for aesthetic reasons (fig. 15). Brick require a smooth, firm base, and generally a 3- or 4-inch concrete slab is placed as a base. After the base has hardened and cured, a layer of sand about 1-inch thick

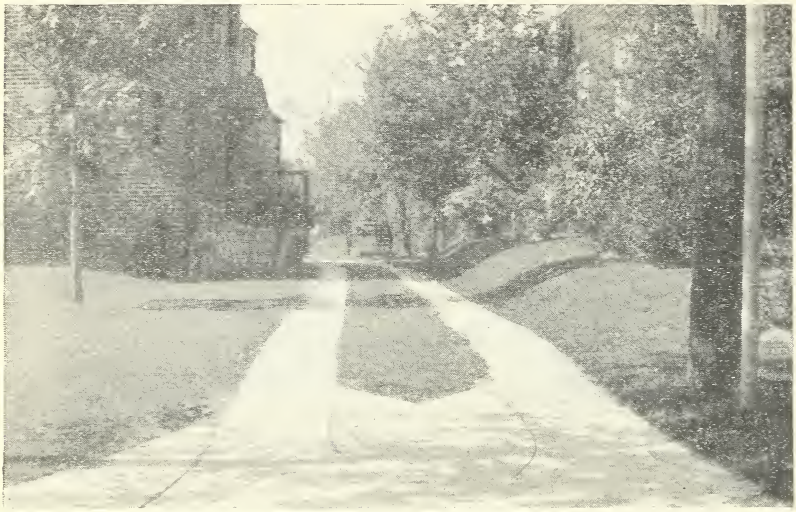

FIGURE 14.—A ribbon-type concrete drive, flared at the near end where it joins the street entrance.

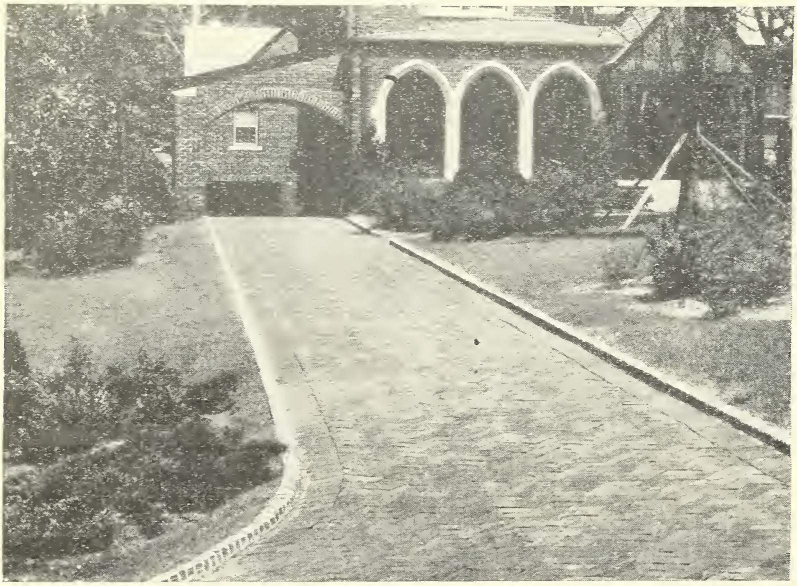

FIGURE 15.—A brick drive that will give long service and harmonizes with the surroundings in excellent taste.

should be place and struck off to a smooth surface. The brick are then placed on the sand layer.

Bases of well-compacted crushed stone, slag, or gravel, or of cement-bound macadam may also be built for brick drives. Side forms, needed for the base, should extend above the base so that they confine the sand cushion and provide lateral support for the brick course.

Heated bituminous filler is now generally used to fill the space between brick when used for street surfacing as this takes care of all expansion troubles. The home owner is not equipped to apply such filler properly. It will probably be better to fill the spaces with a mixture of 1 part cement to 1 part sand and enough water to produce a consistency like cream. This mixture is poured on the surface and broomed into the openings. About every 20 feet courses of brick should be separated by a 1-inch board placed vertically. When the mortar or grout filler has hardened, the board should be pulled out and the space filled with bituminous material as described for expansion joints for concrete. Sand might be used as the filler between bricks, if drainage conditions prevent water from flowing over the drive.

Paving brick are manufactured to resist wear and the forces of nature. Ordinary building brick may last for several years, but they are likely to crumble as a result of freezing and wear, and their use is not recommended.

Since the brick course itself serves chiefly as a wearing surface and furnishes only slight distribution of load, the base course on which brick are placed must be strong enough to give good support. Because of the additional construction operations and cost, brick surfaces are not recommended for drives unless they are desired for aesthetic reasons or can be made of salvaged material.

Cut-stone blocks are sometimes available as salvaged material and they may be used in the same manner as brick (fig. 16).

When the ribbon-type of drive is used, grass can be planted along the middle space and thus add to its appearance, since the lawn generally extends to the drive's edge anyway. Instead of planting grass in the center space, it may be covered with a thin layer of gravel or crushed stone as a check against weed growth.

SUGGESTED WIDTHS FOR STRAIGHT AND CURVED DRIVES

Most drives are designed to be used in the following manner: The car leaves the street or alley, goes forward over the drive and into the garage. On leaving, the car is backed out of the garage, backed over the drive and into the street or alley. Drivers are more adept at handling a car when driving forward than when backing, and drives that are to be used in backing should have greater width than those used for forward driving only.

The following discussion of drive widths presumes that the drives will be used by backing vehicles. For short drives that are to be used only by vehicles moving forward, the recommended widths might be reduced by 4 inches.

Passenger cars are fairly well standardized with regard to several of the dimensions that influence the design of drives. The range of dimensions for a large majority of the passenger cars on our highways is as follows: Gage of front wheels, 55 to 61 inches; gage of rear wheels, 56 to 63 inches; turning radius (radius of the smallest circle that the outside front wheel will trace in turning), 18 to 25 feet; over-all length, 15 to 20 feet; and over-all width, 69 to 78 inches. The length of wheel base, a very important dimension affecting the design of curved drives, ranges from 112 to 154 inches.

Another dimension that must sometimes be considered is the distance from the front axle to the front extremity of the car. As shown in figure 17, this overhang requires a clearance *d* beyond the outside front wheel when the car is on a curve. For most cars this overhang ranges from 26 to 33 inches. On a 30-foot radius curve, a car having a front overhang of 29 inches and a wheel base of 112 inches requires an additional clearance, *d*, of 14 inches on the outside of the curve. Most cars require a clearance of about 8 inches on the inside of a curve (*e*, fig. 17), and a clearance of at least 8 inches should be allowed for on each side of a straight drive.

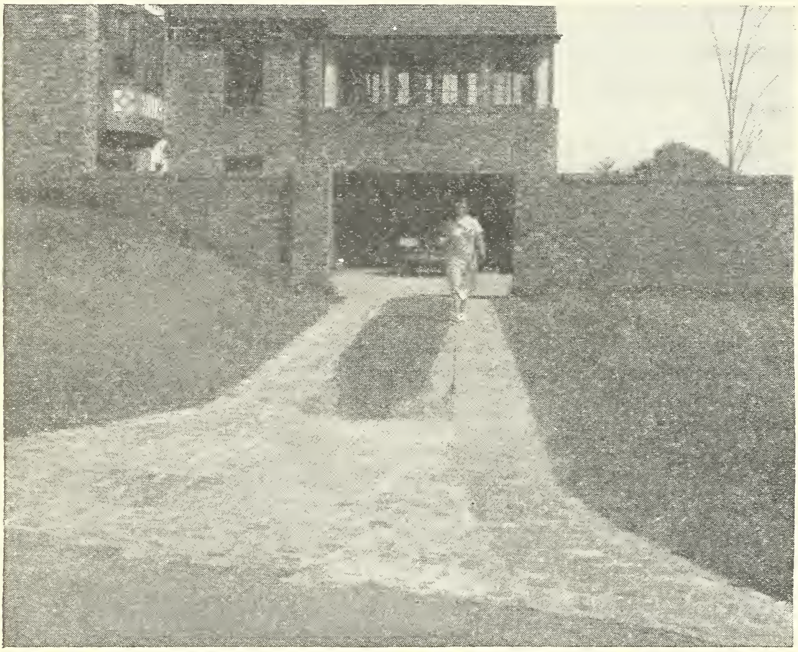

FIGURE 16.—A surface of salvaged cut-stone block with grout filler, laid on a concrete base.

The added width of drive required for these clearances need not be surfaced like the rest of the drive, but allowance should be made for clearances on both sides of drives constructed near such obstructions as buildings, trees, or retaining walls.

In going around a curve, the rear wheels of a car do not follow in the paths traced by the front wheels, but trace paths slightly nearer the center of the curve. The distance between the paths traversed by the outside front and rear wheels when going around a curve is dependent upon the radius of the curve and also upon the length of wheel base. Thus, for a car with a 112-inch wheel base traveling on a 30-foot radius curve, this distance, *f*, is approximately 15 inches, as shown in table 4, and for a car with a 144-inch wheel base traveling this same curve, *f* is approximately 24 inches.

Table 4 lists values of *f* and *d* that are required for cars of various wheel base lengths when traveling around various curves.

Another consideration with regard to widths of curved drives is the direction of the curve. When driving forward, drives curving to the left and those curving to the right can be driven over with nearly the same ease. However, it is definitely easier to back around a drive when the driver is on the inside of the curve than when he is on the outside. In backing around a curved drive the driver, when on the inside, can easily judge the position of the car because a large portion of the drive can be seen. By keeping the left rear wheel near to the inner edge of the drive, the curve can be negotiated with comparative ease. In backing around a drive when the driver is on the outside of the curve, the left rear wheel must be kept away from the outside edge of the drive, but the driver has difficulty in determining his position because the back of the car blocks his view of the drive.

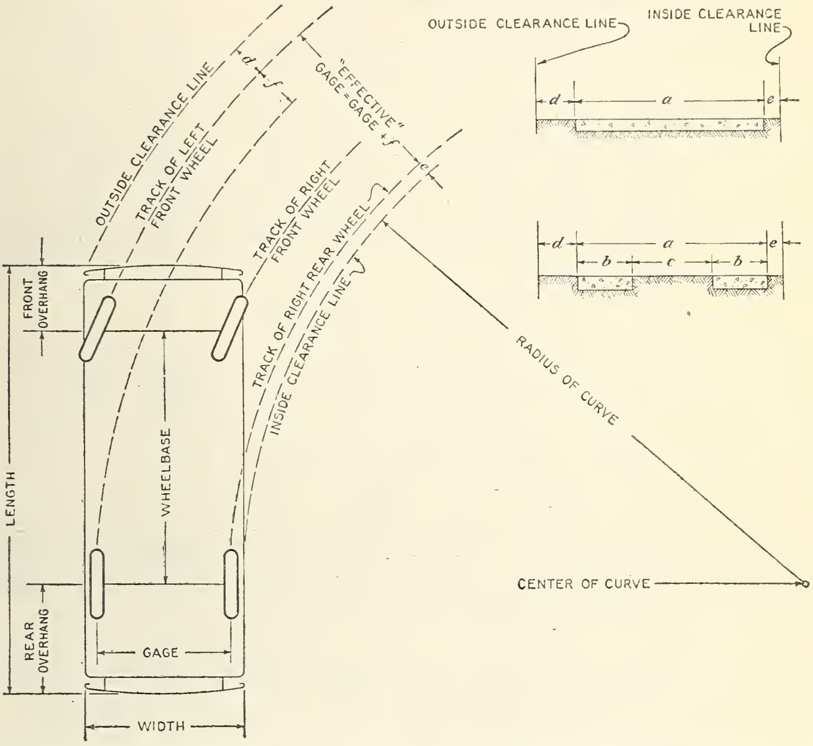

FIGURE 17.—Illustration of wheel offset *f* and clearances *d* and *e*, distances that must be considered on curved drives.

The gage of the average car is 58 inches. When the car is driven straight forward, the two tire tracks are 58 inches apart. However, when driving around a curve the two outside tire tracks are 58 inches apart (the gage) plus *f*, and this total distance may be called the "effective gage" (fig. 17).

TABLE 4.—*Recommended widths of curved and straight drives of both ribbon and slab types*

FOR DRIVES CURVING LEFT[1]

Wheel base	Probable front overhang	Radius of curve	Minimum outside clearance (*d*)	Offset distance (*f*)	Ample			Adequate			Minimum		
					Ribbon width[2] (*b*)	Ribbon spacing (*c*)	Over-all width of surface (*a*)	Ribbon width[2] (*b*)	Ribbon spacing (*c*)	Over-all width of surface (*a*)	Ribbon width[2] (*b*)	Ribbon spacing (*c*)	Over-all width of surface (*a*)
Inches	*Inches*	*Feet*	*Inches*	*Inches*	*Inches*	*Inches*	*Inches*	*Inches*	*Inches*	*Inches*	*Inches*	*Inches*	*Inches*
112	29	20	17	20	------	------	114	------	------	108	44	14	102
		30	14	15	------	------	109	45	13	103	39	19	97
		40	12	12	------	------	106	42	16	100	36	22	94
		50	11	9	45	13	103	39	19	97	33	25	91
		60	11	8	44	14	102	38	20	96	32	26	90
120	29	20	17	23	------	------	117	------	------	111	------	------	105
		30	15	17	------	------	111	------	------	105	41	17	99
		40	13	13	------	------	107	43	15	101	37	21	95
		50	12	11	------	------	105	41	17	99	35	23	93
		60	11	9	45	13	103	39	19	97	33	25	91
132	29	20	18	28	------	------	122	------	------	116	------	------	110
		30	15	20	------	------	114	------	------	108	44	14	102
		40	13	16	------	------	110	46	12	104	40	18	98
		50	12	13	------	------	107	43	15	101	37	21	95
		60	11	11	------	------	105	41	17	99	35	23	93
144	32	20	20	33	------	------	127	------	------	121	------	------	115
		30	17	24	------	------	118	------	------	112	------	------	106
		40	15	19	------	------	113	------	------	107	43	15	101
		50	13	16	------	------	110	46	12	104	40	18	98
		60	12	13	------	------	107	43	15	101	37	21	95
154	33	20	21	37	------	------	131	------	------	125	------	------	119
		30	18	28	------	------	122	------	------	116	------	------	110
		40	16	22	------	------	116	------	------	110	------	------	104
		50	14	18	------	------	112	------	------	106	42	16	100
		60	13	15	------	------	109	45	13	103	39	19	97

FOR STRAIGHT DRIVES[3]

---------	------	---------	6	-------	30	28	88	24	34	82	18	40	76

---

[1] For drives curving right, add 6 inches to ribbon widths and over-all surface widths shown for drives curving left.

[2] Ribbon widths of 46 inches are considered to be the maximum that it is practical to build; therefore, values are not shown for ribbons wider than 46 inches.

[3] Dimensions of straight drives are the same for all lengths of wheel base.

Table 4 lists recommended widths of various types of drives. Those widths termed "ample" are widths over which it is thought that most drivers can easily drive. Those marked "adequate" are widths on which most drivers will need to exercise a little care in order to remain on the drive. Those marked "minimum" are widths on which most drivers will need to exercise considerable care in order to remain on the drive, especially when backing.

Widths of drives with curbs should be greater than those recommended as minimum and adequate in table 4. Delivery trucks that may use the drive will probably have gages wider than 58 inches, and they might run up on and damage the curbs of drives less than 88 inches wide. Trucks might also run off narrower drives without curbs, but they are less liable to damage the drive in doing so.

When a ribbon-type drive is constructed, the centers of the ribbons should be spaced 58 inches apart. Thus the space between ribbons will be 58 inches minus the ribbon width, and for a 40-inch ribbon the space is $58-40$, or 18 inches. The over-all width of a ribbon drive is 58 inches plus the ribbon width; for a 40-inch ribbon, the over-all width is $58+40$, or 98 inches.

Because of construction difficulties, it is not practical to construct concrete or some of the bituminous-mix drives with ribbons more than 46 inches wide, and it is doubtful whether ribbons of this width are desirable. The space between 46-inch ribbons is only 12 inches, and the full width of drive can be surfaced with only a small increase in the amount of materials.

Table 4 gives widths of curved drives required for use by cars having wheel bases ranging from 112 to 154 inches. The widths given in each column vary only because of differences in the offset distance, and these differences are the result of variations in the length of wheel base and the radius of curve. Because the offset distances for a particular curve are greater for the longer cars, greater widths are required.

A drive designed for a long car will easily accommodate the shorter cars. Conversely, curved drives of the widths shown for short cars can be used by longer cars, though more care would have to be exercised to keep the car on the drive. It may not be advisable to design a curved drive for a short car, as the home owner may in the future own a longer car, or the drive may occasionally be used by longer cars owned by friends. On the other hand, the home owner may feel that the expense of building the additional width will not be justified because use by longer cars will be infrequent

STAKING OUT DRIVES

The staking out of a straight drive is fairly simple and can be done with a tape measure, a few stakes, and some string. Stakes can be set along the drive's center line, along its actual outline, or they can be offset 1 or 2 feet from the drive's outer edges. Setting offset stakes is recommended, as they need not be disturbed during construction and thus are constantly available as reference points. The end stakes are first set, and at measured intervals intermediate stakes are set, true alinement being obtained either by eye or by means of a string stretched between the end stakes. An engineer's transit can be used for this purpose if available, though sufficient accuracy can be obtained by the other methods.

After one line of stakes has been set, stakes should be set in the other line directly opposite those already placed. This is best done by locating the end stakes directly opposite those in the first line, and then placing intermediate stakes at the interval used in the first line.

End stakes for the second line are placed the required distance from those already set and on lines through the end stakes and perpendicular to the drive. A handy method of locating this perpendicular line is to construct a right triangle with sides of 6 feet, 8 feet, and 10 feet, as shown in figure 18. In constructing a perpendicular to line XY at point A, point B is located 8 feet from A. Using point B as a center and with a 10-foot radius, arc DE is scratched on the ground. Using point A as a center and with a 6-foot radius, arc FG is scratched on the ground. The line connecting point C, the point where these arcs cross, with point A is the desired perpendicular. A smaller right triangle may be constructed by using the dimensions 3, 4, and 5 feet. For a larger triangle use 12, 16, and 20 feet.

Curved drives are staked out by locating the center of the curve, swinging arcs of the desired radii, and setting stakes at intervals along these arcs. The center of the curve must be on a perpendicular line at the beginning of the curve.

Drives that are straight for a distance and then curve need to be wider on the curve than on the straightaway because the effective gage is greater. At the point where the curve begins the drive needs to be a certain width on the one side for the straight part and a greater width on the other side for the curve. Rather than having an abrupt increase in width at this point, the drive should flare outward from a point on the straight section about 7 to 10 feet from the point of curvature (fig. 19). This flare will add to the appearance of the drive and will enable drivers to negotiate the curve more easily. The appearance of the drive will also be improved by rounding all corners, as shown.

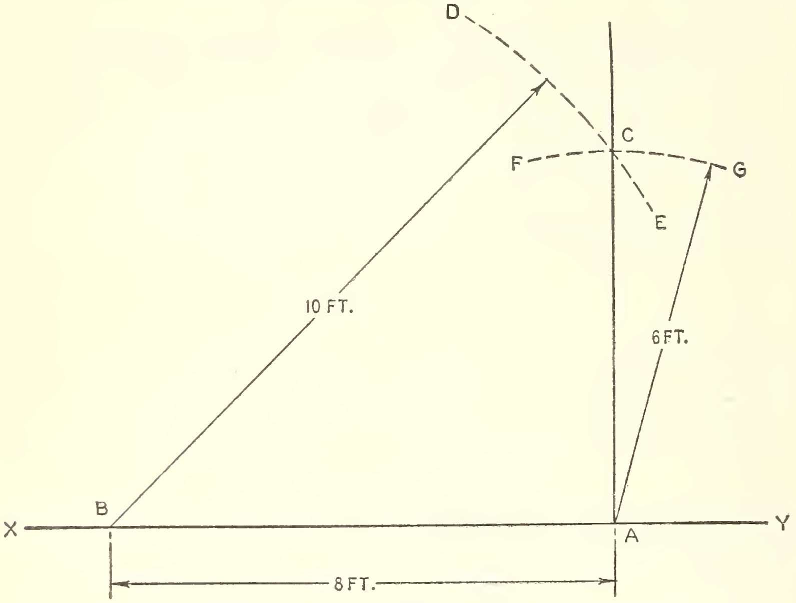

FIGURE 18.—Method of erecting perpendicular to given line XY at point A.

It is suggested that before any drive is constructed it first be staked out, cleared of obstructions, and driven over a few times to determine whether it is satisfactory. The outline of the drive can easily be marked by setting small stakes at intervals and connecting them with white string. A curved drive might even be located by first driving the car over the path where it is desired to build the drive. Stakes could then be set to outline the path traversed, allowing sufficient width so that the proposed drive can be driven over repeatedly without running over any of the outlining stakes.

TURNING AREAS AND STREET ENTRANCES

Home owners sometimes desire that turning areas be built on their drives, particularly if the drive is long or leads from a busy street. Such conditions make backing over the drive difficult or backing into the street dangerous. Drives are sometimes so located that a turning area must be provided to enable entrance to and exit from the garage.

A few designs of turning areas are shown in figures 19 to 22. Any of the materials described for use in drive construction are also adaptable for use in surfacing turning areas. Contraction joints should be provided at 10-foot intervals in each direction in concrete turning areas.

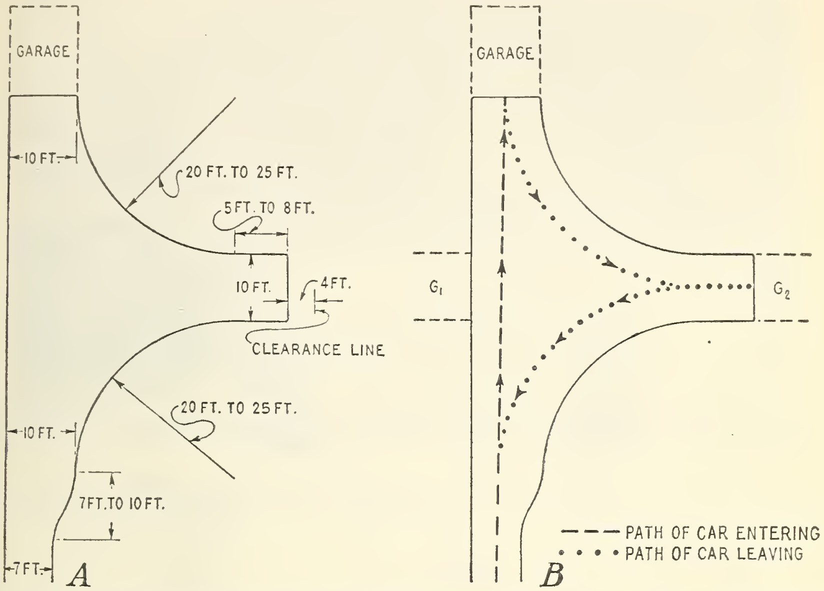

FIGURE 19.—Design of turning Y suitable for alternate garage locations: *A*, ranges in dimensions for short and long cars; *B*, paths of car entering and leaving garage. G1, and G2 indicate alternate garage locations.

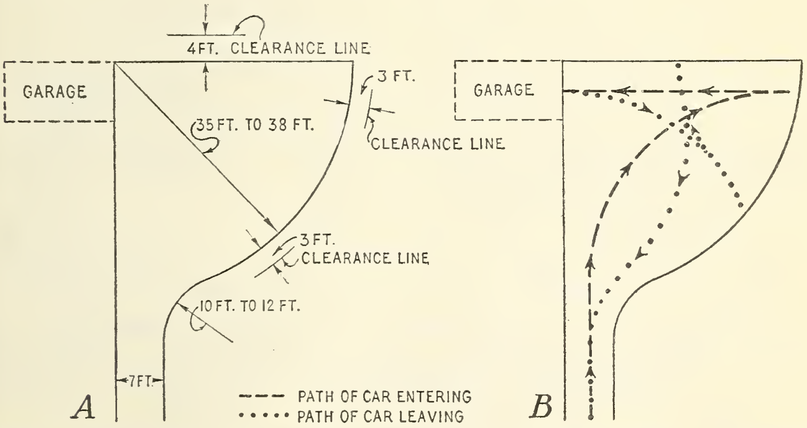

FIGURE 20.—Design of turning area: *A*, ranges in dimensions indicate minimum values for short and long cars; *B*, paths of car entering and leaving garage.

The paths traced by a car when entering and leaving the garage are also shown in these figures. The clearance lines indicated are needed because of front and rear overhang of the car. For most cars the front overhang ranges from 26 to 33 inches; rear overhang ranges from 43 to 57 inches. The ground adjacent to the turning area at these

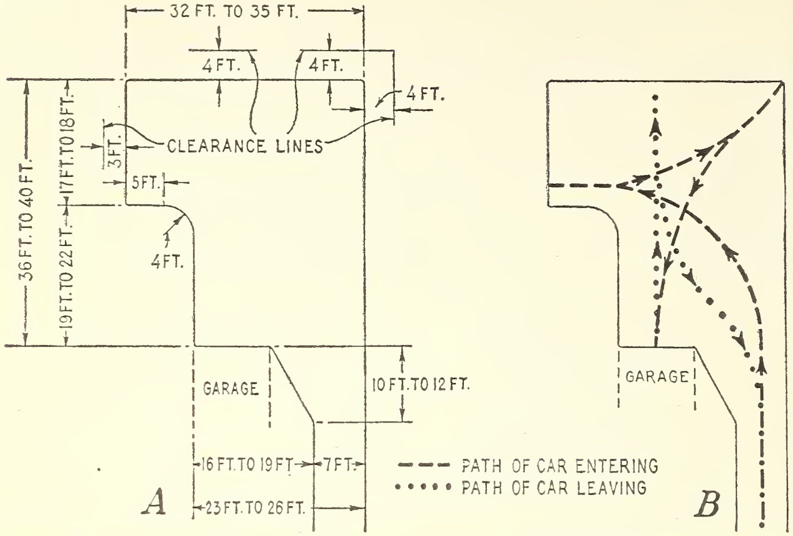

FIGURE 21.—Design of turning area: *A*, ranges in dimensions indicate minimum values for short and long cars; *B*, paths of car entering and leaving garage.

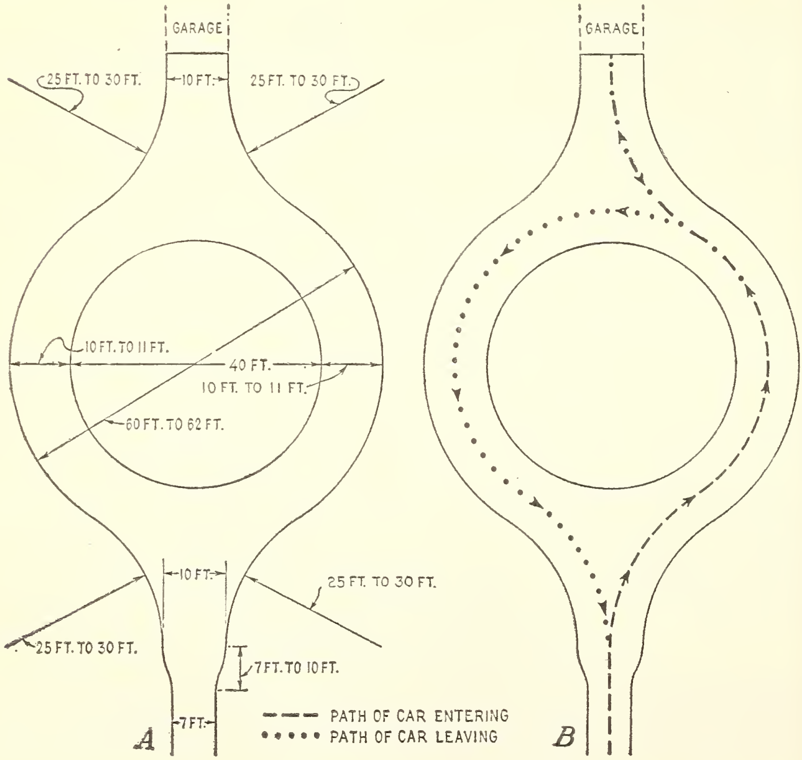

FIGURE 22.—Design of a turning circle: *A*, ranges in dimensions indicate minimum values for short and long cars; *B*, paths of car entering and leaving garage.

clearance lines should be free from obstructions so that the full turning area can be used, as indicated by the dotted and dashed lines.

The turning areas shown are designed to be easily used with a minimum of turning and backing. Some home owners may be faced with space restrictions that do not permit use of the designs or dimensions shown. In such cases more backing and turning may be required to maneuver the car into and out of the garage.

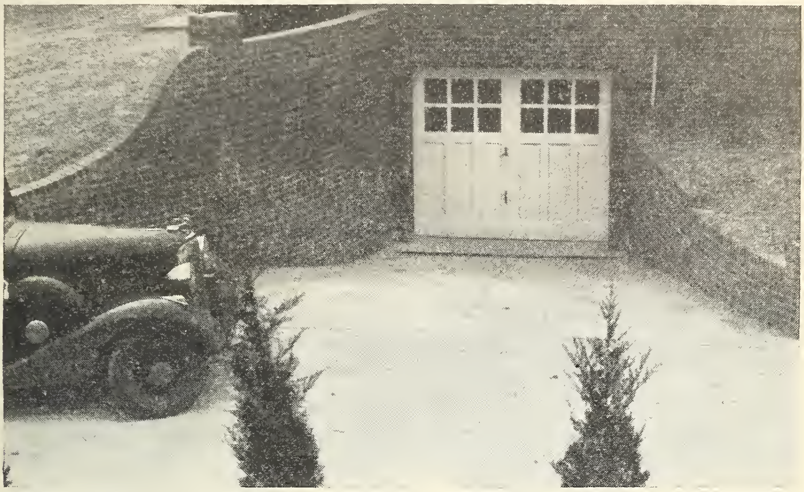

FIGURE 23.—A concrete-surfaced turning area provided at the garage entrance. The entrance slopes downward, and a grill drainage inlet is provided at the bottom of the slope in front of the doors. The brick retaining walls combine attractiveness with utility.

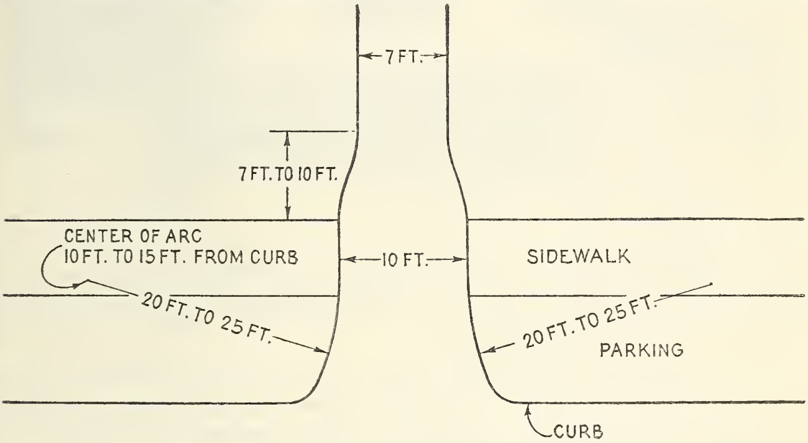

FIGURE 24.—Design of street entrance for drive. Ranges in dimensions indicate minimum values for short and long cars.

Ranges in dimensions are shown in figures 19 to 22. The smallest values are considered suitable for short cars; the largest values are considered suitable for long cars.

A combined entrance and turning area is shown in figure 23.

Because it is easier to choke a cold motor and keep it running whe driving forward, some people prefer to back their cars into the garage Thus, the backing is done when the motor is warm and less likely t stall. A car can either be driven forward or backward into the garag using any of the turning areas shown. However, some backing i necessary both when entering and leaving the garage using the turnin areas shown in figures 20 and 21.

It is suggested that the turning area be staked out, cleared so tha it can be driven over, and then actually tried out to see if the owne considers it satisfactory. Individual driving practices may indicat the desirability of changes in the dimensions or shape of the turnin area.

Several variables are involved in the design of street entrances fo drives. The distance from curb to property line varies in differen cities and on different streets in the same city. The design shown i figure 24 is suggested as adequate for a street 30 feet wide from cur to curb.

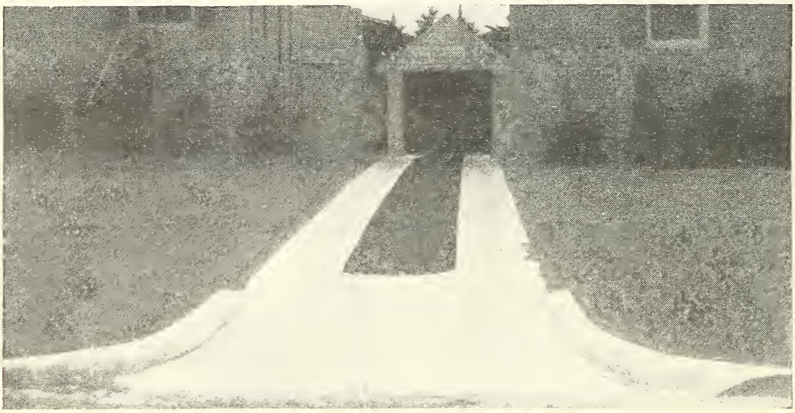

FIGURE 25.—A ribbon-type concrete drive and concrete street entrance with curbs along the sides.

It is desirable that the street entrance be sufficiently wide so that a car can enter the drive without having to swing left across the cente of the street before turning right into the drive. However, this may not be practical on narrow streets.

It is advisable to build curbs along the edges of the street entrance (fig. 25). Since the street entrance slopes upward from the street, the curbs should meet the street curb on the one end and should tape out and be flush with the sidewalk on the other end.

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